Determining Station Location For A Combined ARFF/Structural Response

EXECUTIVE PLANNING

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An applied research project submitted to the National Fire Academy as part of the Executive Fire Officer Program

November, 1997

ABSTRACT

Patrick Air Force Base (PAFB) Fire Department was scheduled to begin construction of a new fire station in fiscal year 2000. The problem was the PAFB Facilities Board chose two possible locations for the new station without soliciting technical input from the fire department. As a result, the new fire station was tentatively slated to be constructed at a site which was not conducive to the needs of the community.

The purpose of this research project was to determine a suitable location for the construction of a new fire station for a combined ARFF/Structural response. An evaluative research procedure was conducted to gather data in order to determine the optimum station location.

The following research questions were addressed:

1. Are there nationally recognized standards which address station location for ARFF response?
2. Are there nationally recognized standards which address station location for structural response?
3. What are the time and distance (time/distance) measurements to critical locations at PAFB?
4. Are Executive Fire Officers with airport fire departments of same size and demographics of PAFB satisfied with the location of their ARFF/Structural station?

5. Do Executive Fire Officers have adequate input during site selection of an ARFF/Structural fire station?

The procedures required a literature review on the subject, a survey instrument of similar sized airport fire departments, and a time/distance study conducted at PAFB. The literature review indicated there were more ARFF than structural standards to assist in the site selection of an airport fire station. The survey instrument found that almost 25% of the respondents were not satisfied with the location of their ARFF/Structural fire station. In addition, many combined ARFF/Structural fire departments do not consider structural response when determining station location. It was also found that quite a few airport fire departments do not have adequate input into the site selection process. The time/distance study provided valuable insight as to measurements of time and distance to critical locations at PAFB.

This report recommended the PAFB Fire Department appeal to the PAFB Facilities Board to change the proposed location for the construction of the new fire station. It also recommended the fire department suggest to the facilities board to construct the new fire station adjacent to the existing structure. Finally, the report recommended to actively petition the National Fire Protection Association (NFPA) to provide more guidance towards a structural response on airports.

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INTRODUCTION

The PAFB fire station was built in 1952. Since then it had undergone numerous additions and renovations. Unfortunately the structure became cost prohibitive for continued use. It was determined a new fire station would be constructed beginning in fiscal year 2000.

The problem was the PAFB Facilities Board chose two possible locations for construction of the station without soliciting technical input from the fire department. As a result, the new fire station was tentatively scheduled to be constructed at a site which was not conducive to the needs of the community.

The purpose of this research project was to determine a suitable location for the construction of a new fire station.

An evaluative procedure was used to research this problem. Research information was obtained at the Learning Resource Center (LRC) located at the National Emergency Training Center (NETC), and the PAFB Fire Department. In addition, a survey instrument was sent to index "C" airport fire departments across the country. Finally, a time/distance study was completed at PAFB. This provided valuable insight as to time and distance measurements of critical locations at PAFB.

The following questions were answered using the evaluative research procedure:

1. Are there nationally recognized standards which address station location for ARFF response?
2. Are there nationally recognized standards which address station location for structural response?
3. What are the time/distance measurements to critical locations at PAFB?
4. Are Executive Fire Officers with airport fire departments of same size and demographics of PAFB satisfied with the location of their ARFF/Structural station?
5. Do Executive Fire Officers have adequate input during site selection of an ARFF/Structural fire station?

BACKGROUND AND SIGNIFICANCE

Patrick AFB is located just south of Cocoa Beach on the east coast of central Florida. Originally known as the Banana River Naval Station the base was used by the Navy for various purposes including submarine patrol during WW II. Some of the remnants of these early missions are still present today. Huge ramps the seaplanes would use to taxi from the hangers to the river for takeoff are still standing as a reminder of days gone by.

The PAFB Fire Department provides fire protection services to an area of approximately 3.3 square miles with a daytime population of approximately 5500 personnel.

The fire department is responsible for providing services to a large industrial/business area, three housing areas (one of which is located off base), and ARFF protection for both the assigned, tenant, and transient aircraft. To accomplish this the fire department had 59 personnel assigned, operating out of one station. A second fire station located in the south housing area (approximately two miles south of the main base) was closed about two years prior to this report due to budget constraints.

The main fire station, which was opened in 1952 consisted of two bays, a small office, and minimal living areas. Over the next 45 years, the station had undergone numerous additions and renovations. As of October 1997 the station consisted of ten apparatus bays, numerous administration offices, two physical fitness rooms, twelve one and two person dorms, male and female restroom with showers, a training room, kitchen, lounge, and patio.

Unfortunately the building was at the end of its useful life. The PAFB Facilities Board had determined it was cost prohibitive for the fire department to continue operation out of this structure. The facilities board had tentatively slated construction for a new fire station to begin in fiscal year 2000 at a cost of approximately 2.5 million dollars.

With the construction slated, the facilities board chose two possible sites for the new station. The sites selected were approximately one-half of a mile from the airfield. In addition the apparatus would have to cross a major thoroughfare in order to access the airfield. This lead to a serious safety concern when the fire department responds to an ARFF incident on the airfield.

This research project was relevant to the Strategic Planning Unit of the National Fire Academy's Executive Planning Course in that it was attempting to proactively identify a problem and plan on how to handle the potential outcomes.

LITERATURE REVIEW

A literature review was conducted in order to gain relevant information concerning station location for a combined ARFF/Structural response. Several significant contributions were found at the LRC located at the NETC and the PAFB Fire Department.

The first area of literature review dealt with relevant national standards concerning ARFF response.

Statistics indicate that approximately 80 percent of all major commercial aircraft accidents occur in the critical rescue and fire fighting access area. This is the primary response area for airport based ARFF services. Approximately 15 percent of the accidents occur in the approach areas (National Fire Protection Association [NFPA] 402, 1996, p. 402-4). The survivable atmosphere inside an aircraft fuselage involved in an exterior fuel fire is limited to approximately 3 minutes if the integrity of the airframe is maintained during the impact. When the aluminum skin is directly exposed to flame, burnthrough will occur within 60 seconds or less while the windows and insulation may withstand penetration for up to 3 minutes. Therefore, whenever flight operations are in progress, ARFF vehicles and personnel should be so located

that optimum response and fire control can be achieved within this time frame. Fire stations should be located so that rapid direct access to the operational runway utilizing maximum acceleration rate and top speed of the vehicles is utilized to enable them to reach any point on the runway. The access road to the runway should be as direct as possible (NFPA 402, 1996, p.402-11).

The most important factors bearing an effective rescue in a survivable aircraft accident are: the training received, the effectiveness of the equipment, and the speed with which personnel and equipment designated for rescue and fire fighting purpose can be put to use. Actual response time is vital (NFPA 403, 1993, p.403-4).

ARFF vehicles shall be garaged at one or more strategic locations as needed to meet required response times. Emergency equipment shall have immediate and direct access to critical aircraft movement areas and capability of reaching all points within the rapid response area (RRA) in the specified time, therefore, the location of the airport fire station shall be based on minimizing response time to aircraft accident and incident high hazard areas. Locating the airport fire station for structural fire fighting utility is of secondary importance (NFPA 403, 1993, p. 403-8).

The demonstrated response time of the first responding vehicle to reach any point on the operational runway shall be 2 minutes or less and to any point remaining within the on-airport portion of the RRA shall be no more than 2 ½minutes, both in optimum conditions of visibility and surface conditions (NFPA 403, 1993, p. 403-8).

The geographical center of an airport might not be the best location for sitting the airport fire station. Before selecting the actual location, time trials should be run to determine the optimum location that ensures the quickest response to all potential accident sites. Also, an evaluation should be placed on present and future usage of the airport movement areas to ensure proper selection of the fire station site. Care should be taken to ensure that access to or from the airport fire station cannot and will not be blocked by taxiing or parked aircraft or vehicular traffic (NFPA 403, 1993, p. 403-20).

The following checklist stresses ARFF vehicle response factors, station operations, and cost effectiveness:

1. Immediate, straight, and safe access towards the airside.
2. Unimpeded access routes with a minimum of turns to runways, taxiways, and aircraft parking areas.
3. Direct access to the terminal aprons without crossing active runways, taxiways, and aircraft parking areas.
4. Noninterference with the air traffic control tower's line of sight.
5. Maximum surveillance of the air operations area.
6. Shortest response times to the most probable aircraft accident areas.
7. Compliance with building restriction lines.
8. Future additions or expansions (of the fire station).
9. Airport expansion, such as new runways or extensions that will not jeopardize its emergency service areas by creating emergency response runs of excessive length.

10. Noninterference by ARFF vehicle or station radios with airport navigational facilities.

11. Minimum obstructions or interference which would hamper an expeditious ARFF response.

(Federal Aviation Administration [FAA], 1987, p. 7-9)

The FAA mandates ARFF response requirements in FAA Regulation Part 139 (1989). Within 3 minutes from the time of the alarm, at least one required ARFF vehicle shall reach midpoint of the farthest runway from its assigned post, or reach any other specified point of comparable distance on the movement area which is available to air carriers, and begin application of fire extinguishing agents.

Department of Defense (DoD) Fire and Emergency Services Program (1994) mandates the first arriving ARFF apparatus shall be capable of responding to any incident on the runways or overruns within 3 minutes of an unannounced emergency. This directive applies only to those fire protection organizations which serve DoD facilities.

The second area of literature review dealt with structural response.

The Insurance Service Office (ISO) recommends the built upon areas of the city to have a first-due engine company within 1.5 miles of any given structure in its district (ISO, ed. 6-80).

DoD (1994) bases time requirements on the strategic importance and mission criticality of the particular structure. Aircraft hangars, hospitals, and industrial/warehouses for instance require a five minute response while nine minutes is an acceptable response for dwellings and trailer courts. The response time is extended to fifteen minutes for isolated or scattered structures.

The prospective site should allow for direct access to the district's major roadways. This does not mean the fire station should be located on a major thoroughfare. In fact, to avoid traffic congestion choose a site on a side street right off the main road. Avoid locations near any major obstacles to driving within the fire district such as railroad right of ways, interstate highways, large parks, colleges, or other institutions (de Silva, 1990).

Often fire stations are located on major travel routes, based upon the thinking the response time is the most efficient. While this approach has some validity, property which may be very expensive real estate could be removed from the tax roles. An alternative approach is to locate the station on a secondary route, just off from the major route, and use a signalized intersection to allow safe access to the major route (Cricenti, 1997).

The Fire Chief's Handbook (de Silva, 1995) gave some broad recommendations for structural station location such as one mile for commercial areas, two miles for residential areas, and three miles for low-density areas. It goes on to state that these guidelines must be adjusted for local traffic conditions, levels of fire hazard, and budget constraints.

PROCEDURES

The research procedures used in this report included a literature review, a survey instrument of index "C" airport fire departments across the country, and a time/distance study accomplished at PAFB, Florida.

The literature review consisted of gathering data from all relevant information available at the NETC (LRC) and the resource library located PAFB Fire Department.

The survey instrument was constructed in such a manner to provide data towards the posed research questions. A pilot test of the survey instrument was performed on members of the PAFB Fire Department. This was done to ensure the readability and understandability of the questionnaire. After a few minor adjustments the survey instrument was sent to the target audience.

The survey instrument was administered to executive fire officers located at index "C" airports across the country. Airport index ratings are determined by the FAA and are outlined in FAA Regulations Part 139 (1989). The regulation relates an index "C" airport has five or more average daily departures of aircraft at least 126 feet in length but less than 159 feet in length. MD-80, DC-9, and Boeing 727 aircraft would fall into this category. Index "C" airports were chosen because the offered the same size and demographics of the airfield located at PAFB. Most index "C" airport fire departments operate out of a single station serving one or two

runways. Larger airports have multiple stations serving three or more runways. Addresses for Index "C" airport fire departments were obtained via the FAA website on the internet.

Eighty five surveys were distributed with 58 returned for a 68 percent response. As this number is a relatively small sampling as compared to all airport fire departments across the United States, the assumption should not be made that it is representative of all airport fire departments. Rather it is represented an acquired sampling of a small target audience.

The questionnaire examined thirteen questions regarding station location for airport fire departments. The first question asked whether their fire department had a structural response in addition to ARFF duties. The next question asked how many fire stations they had on airport property. Question three asked the respondent if their fire department had a combined ARFF/Structural station constructed within the last ten years. How the respondent answered these questions determined whether to continue on or skip to question eleven. Respondents who continued on were asked several questions on factors which influenced the station location from both an ARFF and structural standpoint. Question eleven and twelve asked if the respondent was satisfied with the location of their respective station and if they felt enough consideration was given to structural response during site selection. Last the respondent was asked if they had adequate input during the site selection process (Appendix A).

The time/distance study was completed on 18 Oct 97 at Patrick AFB, Florida. A staff vehicle was utilized to simulate responses to various critical locations on base. All driving was done at

night with very little road traffic. Road conditions were favorable and the weather was clear. Critical locations were determined in accordance with FAA and DoD regulations as well as ISO and Fire Chief Handbook guidelines.

The first portion of the study dealt with structural response. Building 310 which was located at the north end of the base and South Oak Street which was located in south housing were selected because they represented the extreme north and south boundaries. Patrick AFB is relatively narrow, thereby it was determined all east/west boundaries fall within the same distance requirements as the north/south boundaries.

Beginning with the existing station, the staff vehicle was driven (non-emergency status) to each location. Odometer readings were utilized to determine distance (rounded to the closest tenth) and a stop watch was used to document time. Once the data was collected for the existing station, the test was repeated at the tentative location for the new station. As there were two possible tentative locations adjacent to each other, the starting point was between the two locations. The last test was conducted from an alternate position located next to the new aircraft control tower (south of the existing and proposed station locations). This provided a comprehensive study from different areas of the airfield.

The second portion of the time/distance study dealt with ARFF response. Four locations based on FAA and DoD regulations were chosen. They were: the approach of runway 11, the approach of runway 29, the approach of runway 02, and the 750 flightline. The same methods as

used in the structural study were used for the ARFF with one exception. The ARFF test was accomplished after flying went down for the day. Through coordination with the aircraft control tower, clearance was given for the entire airfield. This allowed the test to be conducted utilizing true emergency response technique. As it would not have been feasible to conduct the structural study in emergency response status, the writer felt the lack of road traffic would compensate for the time difference.

Project Limitations

In order to complete the research project in a timely manner a relatively small target audience was chosen for the survey instrument. While painstaking efforts were made to determine the audience which would offer the most experience and expertise, index "C" airports are only a fraction of all airport fire departments across the United States. Unfortunately, it would have been impractical to attempt to survey every airport fire department in the country. It was also assumed the respondents were knowledgeable of their respective organizations concerning station location and would answer the questionnaire honestly.

Limiting factors of the survey were the small population served and the ability to determine whether this small population was representative of all airport fire departments across the country.

In regards to the time/distance study, the distance measurement was objective (providing the odometer was properly calibrated), while the time data was somewhat subjective. Many factors

can influence response time. Some of these factors are: weather, time of day, traffic, and road conditions to name a few.

The limiting factor of the time/distance study was the subjective aspect of the time results.

Definitions

Actual Response Time- the total period of time measured from time of alarm until the first ARFF vehicle arrives at the scene of an aircraft accident and is in position to apply agent (NFPA, 1993, p. 403-4).

Airport- an area of land or other hard surface, excluding water, used for the landing and takeoff of aircraft and includes buildings and facilities (FAA, 1987).

Announced Emergency- when ARFF personnel have pre-warning of a possible aircraft accident. This is usually accomplished when the pilot of an aircraft declares an in-flight emergency to the air traffic controller. ARFF apparatus will proceed to pre-determined standby locations to wait for the emergency aircraft to arrive.

ARFF- Aircraft Rescue and Fire Fighting- the fire fighting action taken to prevent, control, or extinguish fire involved or adjacent to an aircraft for the purpose of maintaining maximum escape routes for occupants using normal and emergency escape routes for egress.(NFPA, 1996, p. 402-4).

Critical Response and Fire Fighting access area- the rectangular area surrounding any runway within which most aircraft accidents occur on airports. Its width extends 500 ft. from each

side of the runway centerline, and its length is 3300 ft. beyond each runway end (NFPA, 1996, p.402-5).

Movement Area- the runways taxiways, and other areas of an airport which are used for taxiing or hover taxiing, takeoff, and landing of aircraft exclusive of loading ramps and aircraft parking areas (FAA, 1987).

Rapid Response Area- a rectangle that includes the runway and the surrounding area to but not beyond the airport property line. Its width extends 500 ft. outward from each side of the runway centerline, and its length is 1650 ft. beyond each runway end (NFPA, 1993, p. 403-5).

Unannounced Emergency- when ARFF personnel have no pre-warning of an aircraft accident. This usually occurs while an aircraft is taking off or landing. ARFF vehicles will be responding from the airport fire station(s).

RESULTS

The results of this research project were gathered from three areas: a literature review, a survey instrument, and a time/distance study. The goal in each area was to collect data on station location for a combined ARFF/Structural response.

Research Question 1

Are there nationally recognized standards which address station location for ARFF response?

There were four national standards which had major influence over station location for ARFF response.

1. NFPA 402, Aircraft Rescue and Fire Fighting Operations.

"This standard provides information relative to aircraft rescue and fire fighting operations and procedures for airport and structural fire departments. These procedures deal with aircraft not involved in military operations. They can, however, be generally applicable to military aircraft not operating in an armament mode"(NFPA, 1996).

Data was gathered from this standard regarding aircraft mishaps; specifically where the majority of them occur. Tactics and strategy were also approached in so much as to stress the importance of an expeditious response to facilitate rescue. Additionally definitions found in this standard were used throughout the project.

2. NFPA 403 Aircraft Rescue and Fire Fighting Services at Airports.

"This standard contains the minimum requirements for aircraft rescue and fire fighting services at airports"(NFPA, 1993).

This standard gave some specific time requirements which must be considered when placing an ARFF station as well as insight why it is critical for these times to be met. In addition, this standard was explicit to inform the reader that locating an airport fire station for structural response is of secondary importance.

3. FAA Part 139, Certification and Operation: Land Airports Serving Certain Air Carriers.

This standard describes in great detail the ARFF protection to be provided on airports. Based on the size of aircraft utilizing the airport, the standard will dictate what type of apparatus and the minimum response times to be achieved. Although DoD does not employ FAA standards to rate DoD airfields, it was determined PAFB offers the same size and demographics of an index "C" airport. Under this standard PAFB Fire Department would be required to maintain an apparatus force (at least two vehicles) capable of delivering 500 pounds of dry chemical and 3000 gallons of water/foam solution. The station would need to be located in such a manner to facilitate a three minute response on an unannounced alarm to midpoint of the farthest runway and begin application of fire fighting suppressants.

4. DoD Instruction, Fire and Emergency Services Program.

"This Instruction applies to the Office of the Secretary of Defense, the Military Departments, and those Defense Agencies having responsibility for maintaining organized fire and emergency services" (DoD, 1994).

Like the FAA, this instruction dictates the minimum apparatus and response times to be achieved. Under these regulations PAFB Fire Department must maintain three ARFF vehicles with a 9000 gallon total water/foam solution. Stations will be located so the first arriving ARFF vehicle can reach any point on the runways or overruns within three minutes of an unannounced alarm. The instruction also mandates structural fire suppression forces will respond on all ARFF alarms to provide additional rescue and fire suppression personnel to establish agent resupply.

Seventy-one percent of the respondents who had a combined ARFF/Structural fire station built in the last ten years indicated they utilized FAA regulation as a basis for determining location. This was followed by NFPA standards in which twenty-nine percent of the respondents used as a basis for station location determination.

Research Question 2

Are there nationally recognized standards which address station location for structural response?

There were three national standards which had major influence in determining station location for structural response.

1. Insurance Service Office (ISO) Fire Suppression Rating Schedule.

"For over a century, the insurance industry in the United States has been evaluating the fire defenses of cities, towns, and villages. This evaluation process is an important element in establishing fire insurance rates for individual properties" (ISO, ed. 6-80).

The ISO recommends the developed areas of a city have an engine company within 1.5 miles of any structure in its first due area.

2. The Fire Chief's Handbook.

"Response time is the most critical item in site selection. Generally a target for response distance should be set in accordance with practical department experience and accepted standards" (deSilva, 1990).

The handbook recommends stations be located so engine companies have a one mile first due radius for commercial areas. Two miles is the allowable radius for residential areas, and three miles for low-density areas. The standard relates these guidelines may be adjusted for traffic conditions, levels of fire hazard, and budget constraints.

3. DoD Instruction, Fire and Emergency Services Program.

Station location for structural response is based on time requirements to various structures depending on their strategic importance.

Twenty-nine percent of the survey respondents indicated they utilized NFPA standards as a for determining structural station location. This was followed by ISO standards (twenty-one percent), and The Fire Chief's Handbook (seven percent). Forty-three percent of the respondents indicated they did not consider structural response when planning the location of their fire station.

Research Question 3

What are the time and distance measurements to critical locations at PAFB?

A time and distance study was performed to gather data specific to PAFB. The results of this study are recorded on the following graph (figure1):

LOCATION	EXISTING STATION	PROPOSED LOCATION(S)	ALTERNATE LOCATION
Approach of 11	0.8 miles (1:04)	2.2 miles (3:05)	1.5 miles (1:52)
Approach of 29	0.2 miles (0:17)	1.6 miles (2:25)	1.0 miles (1:18)
Approach of 02	1.7 miles (1:35)	1.3 miles (2:06)	0.8 miles (0:56)
750 Flightline	0.7 miles (0:53)	2.3 miles (3:15)	1.7 miles (1:58)
Building 310	1.5 miles (3:01)	2.2 miles (4:38)	2.0 miles (4:34)
South Oak Street	4.2 miles (7:48)	3.7 miles (6:35)	3.5 miles (6:15)

(Figure 1)

The top row of the graph indicates the three locations the test was started from. Going down the first column are the critical locations where each individual test was concluded. The remaining columns show the specific data for each individual test displaying miles first, then time in parenthesis.

Research Question 4

Are Executive Fire Officers with airport fire departments of same size and demographics of PAFB satisfied with the location of their ARFF/Structural station?

A survey instrument was applied in order to document satisfaction with the location of ARFF/Structural stations protecting comparable sized airports.

Seventy-eight percent of the respondents indicated they were satisfied with the location of their station. Twenty two percent of the respondents were not satisfied.

Research Question 5

Do Executive Fire Officers have adequate input during site selection of an ARFF/Structural fire station?

The survey instrument was used once again to document the level of input an Executive Fire Officer has during the site selection of an ARFF/Structural fire station.

An unexpected trend was found when compiling the results of the survey instrument. The question regarding input was posed to all participants of the survey. Fifty-seven percent of all the respondents indicated they had adequate input during the site selection process. The remaining forty-three percent indicated they did not have adequate input during the process.

It was noticed while compiling the data a greater number of respondents who had a station built in the last ten years indicate they did not have adequate input during the site selection process. When the figures were recalculated using only the respondents who had a station built in the last ten years seventy-two percent of the respondents felt they did not have adequate input during the site selection process.

DISSCUSSION

The literature review, survey instrument, and time/distance study which were used for this research project brought forth quite a bit of interesting information from several areas. Answers to the questions on the survey instrument, notes added by many of the respondents, and material reviewed provided an insight as to the guidelines for proper placement of an ARFF/Structural fire station.

First it was concluded there is an abundance of directives regarding ARFF response but very little concerning structural response. Additionally there are virtually no guidelines specifically tailored for a combined ARFF/Structural response.

The FAA makes it perfectly clear in Certification and Operations: Land Airports Serving Certain Air Carriers that apparatus will be so located as to facilitate a three minute response to midpoint of the farthest runway. This would be considered the minimum standard to which any certified ARFF service would need to maintain. As PAFB is a military installation, the base

must adhere to minimum standards set forth in DoD Fire and Emergency Services Program. These standards exceed the FAA requirements in that the apparatus must be able to reach any point of the runways or overruns within three minutes. The overrun of the farthest runway could be considerably more distant than mid-field. NFPA standards recommend ARFF apparatus to reach any point on the operational runway within two minutes. This exceeds both previous standards.

It was determined from a time/distance study of PAFB, the proposed location(s) for the new fire station failed to meet the time requirement as set forth by DoD to half of the critical ARFF response areas (Figure 1). Furthermore, it could not meet the two minute response as set forth by NFPA in any of the time tests. It also should be noted the response times from the proposed station location(s) could be considerably longer depending on the traffic conditions of a major thoroughfare the ARFF apparatus would have to cross to gain access to the airfield. The writer felt it was for this reason NFPA 403 specifies an ARFF fire station will not be placed in such a manner as to cross vehicular traffic to gain access to the airfield. ARFF vehicles are very large and cumbersome (more than structural apparatus). They take a long time to build up speed; therefore each time they must slow down or stop (as for curves or intersections) the response times will increase dramatically. Locating the station in such a manner as to have to cross a roadway to access the airfield would create an extremely hazardous situation. The personnel on the aircraft are at greater risk due to an increased response time. Additionally, ARFF crews and civilians are at a tremendous risk of a severe vehicle accident. It would not be “if” but rather

"when" an accident would occur by allowing ARFF apparatus to cross a roadway in response to an airfield incident.

Second it was found structural response is not regulated or monitored to the degree of ARFF response. While three standards were found, NFPA standards were not one of them. NFPA does have standards for structural fire suppression (NFPA 1201, Developing Fire Protection Services for the Public), but as of this writing response times were not addressed. A reason for this was found through a personal interview with James Tolley, President of International Association of Fire Fighters (IAFF) Local 1951. He related that the NFPA was in the midst of a heated debate concerning response times. The IAFF and several other organizations were pushing towards the inclusion of response times in NFPA standards while other organizations are against them. He went on to relate that the majority of volunteer organizations, for instance, do not want time requirements for fear they would not be able to meet them (10 Oct 97). What the writer found interesting was although NFPA does not have a standard to assist in determining station location for structural response, twenty-nine percent of the survey respondents indicated they utilized NFPA for the determination of station location.

Of the three standards found regarding structural response DoD Fire and Emergency Services Program is the only actual directive. The ISO Fire Suppression Rating Schedule is an insurance based system in which property insurance pay-outs is the motivating factor. While the writer concedes this does have somewhat of a positive trickle down effect, quite a bit of ISO's standards are antiquated to modern firefighting. Furthermore, while it may be helpful as a

guideline, PAFB does not purchase fire insurance as does the civilian population. As a result, PAFB would not enjoy the monetary benefit associated with a good ISO rating.

While The Fire Chief's Handbook is recognized as a leading publication dealing with executive management of a fire department, it is a text book not compiled in a standard format.

As stated above, PAFB as a military organization is bound to adhere to minimum requirements as set by DoD. The time/distance study determined all three possible station locations satisfied these requirements (Figure 1). While the south housing times were fairly long, DoD allows a fifteen minute response time to isolated buildings. South housing is approximately two miles south of the base. In addition PAFB had a automatic aid agreement with Brevard County Fire Rescue (BCFR). This allowed a much quicker response time as BCFR had a fire station staffed with career personnel located adjacent to the south housing area. The existing fire station had the best structural response time as it was the only location to meet ISO recommendation for an on-base response. Another positive aspect of the existing location was the proximity to highway A1A which was located across the street from the station. Emergency crews could access A1A by use of an automatic vehicle gate. This facilitated a quicker structural response to several base areas.

Virtually no standards were found addressing station location for a combined ARFF/Structural response. NFPA 403 contained one sentence relating that locating the airport

fire station for structural fire fighting is of secondary importance. This may have translated to no importance to many of the respondents as forty-three percent indicated they did not consider structural response in determining location for their combined ARFF/Structural fire station. This seems to justify why almost one-quarter of the respondents were not satisfied with the location of their respective stations.

While most of the material gathered in the literature review was geared toward either ARFF or structural response (one or the other), a lot could actually be applied to both roles in a dual function.

Regardless whether the station is built for structural , ARFF, or combined response, it must be preemptive rather than reactive. Future growth must be considered when sitting a fire station. This means the designer must look ahead up to fifty years to attempt to determine growth patterns of the area (Cricenti, 1997). PAFB is located on a barrier island in a suburban area. Although there may be some new construction on base, there will never be any additional land annexed. Likewise, the runways are established for maximum length and wind direction; because of this they will remain the same as long as jet aircraft are utilized.

The Fire Protection Handbook suggested to locate the fire station on a secondary street just off the major thoroughfare. This would keep prime real estate available for commercial use thus increasing the tax base. As this does not directly impact PAFB as a traditional property tax

system is not utilized, it may be advisable to leave the main road "prime real estate" available for use by another organization. The other organization may be able to utilize the main road location more safely so long as response efficiency is not sacrificed.

Lastly it was concluded that Executive Fire Officers do not have adequate input during the site selection of a combined ARFF/Structural fire station. This was not noticed at first as fifty-seven percent of the respondents indicated they had adequate input during the site selection process. Once figures were recalculated including only those respondents who had a station built in the last ten years the percentage dropped to twenty-eight. The writer could only speculate as to the reason for such a vast difference of opinion. Could it possibly have been the Executive Officers who not had a station built in the last ten years be under the false impression they would be included in the process should the need for a new station arise? If so many of them are in for an unpleasant surprise.

RECOMMENDATIONS

As a result of this research project, the writer makes the following recommendations:

1. Appeal to the PAFB Facilities Board to change the proposed site for the location of the new fire station. The proposed location(s) failed to meet the majority of response requirements as set forth by DoD, FAA, and NFPA. It would also create a tremendous safety hazard if ARFF apparatus were so located as to require them to cross a major

roadway to access the airfield. Additionally, it ranked lowest for structural response in the time/distance study.

2. Suggest to the PAFB Facilities Board to construct the new fire station adjacent to the existing station. A large hanger and ramp facility immediately north of the existing structure is due to be demolished before the fire station project. The existing station location had by far the best ARFF response times. Structural times were also within required guidelines. In addition, quick access to highway A1A afforded an excellent response opportunity to several key areas of the base.

3. Actively petition the NFPA to provide more guidance about structural response on airports. This could be done as an additional chapter in NFPA 403 Aircraft Rescue and Fire Fighting Services at Airports. As of this writing NFPA regards ARFF services as a segregated function while many fire departments maintain a dual role.

REFERENCE LIST

Cricenti, N.J. (18th ed.). (1997). Fire Department Facilities And Fire Training Facilities. Fire Protection Handbook. (A.E. Cote, Editor). Quincy: R.R. Donnelly & Sons.

de Silva, D. (1990, January). From the Ground Up: Constructing or Reconstructing a Modern Firehouse. Fire Engineering. 32-35.

de Silva, D.(5th ed.). (1995). Fire Station and Facility Design. The Fire Chief's Handbook. (J.R. Bachtler & T.F. Brennan, Editors). Saddle Brook : Penn Well.

Department of Defense. (1994). Fire and Emergency Services Program. Washington: Author.

Federal Aviation Administration. (1987). Airport Rescue and Fire Fighting Station Building Design. Washington: Author.

Federal Aviation Administration. (1989). Certification And Operations: Land Airports Serving Certain Air Carriers. Washington: Author.

Insurance Services Office. (ed. 6-80). Fire Suppression Rating Schedule. Parsippany: Author.

National Fire Protection Association. (1996). NFPA 402 Aircraft Rescue and Fire Fighting Operations. Boston: Author.

National Fire Protection Association. (1993). NFPA 403 Aircraft Rescue and Fire Fighting Services at Airports. Boston: Author.

National Fire Protection Association. (1994). NFPA 1201 Developing Fire Protection Services for the Public. Boston: Author.

APPENDIX A

Determining Station Location For A Combined ARFF/Structural Response
Executive Fire Officer Project
By Dominick Landolfi
Assistant Fire Chief
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The purpose of this questionnaire is to obtain data as part of a research paper to identify factors in determining location for a combined ARFF/Structural fire station. This research paper is a project for the Executive Fire Officer Program of the National Fire Academy.

Please take a few moments to answer the following questions. Questionnaires should be returned by **Friday, August 8th, 1997.** A self-addresses stamped envelope is enclosed for your convenience.

Your assistance is greatly appreciated!!

1. Does your department have a structural response area in addition to ARFF?

yes_____ no_____

2. How many stations does your department have on airport property?

_____

3. Has your department built a combined ARFF/Structural fire station in the last ten years?

yes_____ no_____

If you answered "yes" to the above question, please continue. If you answered "no", please skip to question #11 at this time. Thank You.

4. Were you (the ARFF division) actively involved in the site selection of the station or was the site "selected" for you?

actively involved_____ not involved_____

If you answered "actively involved" to the above question, please continue. If you answered "not involved", please skip to question #11 at this time. Thank You.

5. What type(s) of reference(s) did you use in your analysis of station location regarding ARFF response? (check all that apply)

FAA Regulations_____ NFPA Standards_____

Trade Publications_____ Other (explain)_____

_____

_____

_____

6. Of the above answers, which reference influenced your station location regarding ARFF the most?

_____

7. Did you consider structural response when planning the location of your station?

yes_____ no_____

8. If structural response was a consideration in your station location analysis, what reference(s) did you use to assist your decision? (check all that apply)

NFPA Standards_____ Fire Chief's Handbook_____

ISO Standards_____ Trade Publications_____

Other (explain)_____

_____

_____

_____

9. Of the above answers, which reference influenced your station location regarding structural response the most?

_____

10. Did you experience any difficulty determining a suitable location to meet both ARFF and structural response criteria?

yes_____ no_____ (please explain)_____

_____

_____

_____

11. Are you satisfied with the location of your airport fire station?

yes_____ no_____

12. Do you feel adequate consideration is given to structural response when selecting a site for a combination ARFF/Structural fire station?

yes_____ no_____

13. Do you feel the fire protection (ARFF) division has adequate input during the site selection process regarding station location?

yes_____ no_____

Please feel free to attach any support materials you feel may be helpful on this subject

Thank You For Your Participation!!